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Foreword

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Contents

Intellectual Property Rights 2
Foreword 2
Foreword 5
Introduction 5
1 Scope 6
2 References 6
3 Definitions and abbreviations 7
3.1 Definitions 7
3.2 Abbreviations 7
4 SON Policy and Optimization Function Definitions 7
4.1 Monitoring and Management Operations for Self-Optimization 7
4.1.1 Monitoring and Management Function 7
4.1.1.1 Usage of Itf-N 7
4.2 Load Balancing Optimization Function 8
4.2.1 Objective and Targets 8
4.2.2 Parameters To Be Optimized 8
4.2.3 Optimization Method 8
4.2.3.1 Problem Detection 8
4.2.3.2 Problem Solution 9
4.2.4 Architecture 9
4.2.4.1 Definition of Logical Functions 9
4.2.4.2 Location of Logical Functions 9
4.2.5 PM 9
4.3 Handover (HO) Parameter Optimization Function 10
4.3.1 Objective and Targets 10
4.3.2 Parameters To Be Optimized 10
4.3.3 Optimization Method 11
4.3.3.1 Problem Detection 11
4.3.3.2 Problem Solution 11
4.3.4 Architecture 11
4.3.4.1 Definition of Logical Functions 11
4.3.4.2 Location of Logical Functions 12
4.3.5 PM 12
4.4 Interference Control Function 13
4.5 Capacity and Coverage Optimization Function 13
4.6 RACH Optimization Function 13
5 Information Object Classes (IOCs) 13
5.1 Information entities imported and local labels 13
5.2 Class diagram 14
5.2.1 Attributes and relationships 14
5.2.2 Inheritance 14
5.3 Information Object Class (IOC) definitions 15
5.3.1 SONTargets 15
5.3.1.1 Definition 15
5.3.1.2 Attributes 15
5.3.1.3 Attribute constraints 15
5.3.1.4 Notifications 15
5.3.2 SONControl 15
5.3.2.1 Definition 15
5.3.2.2 Attributes 15
5.3.2.3 Attribute constraints 15
5.3.2.4 Notifications 16

5.4 Information relationship definitions 16
5.5 Information attribute definitions 17
5.5.1 Definition and legal values 17
5.5.2 Constraints 20
5.6 Common Notifications 20
5.6.1 Configuration notifications 20

Annex A (informative): Change history 21

History 22

Foreword

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Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project Technical Specification Group Services and System Aspects, Telecommunication management; as identified below:

32.521: Self-Organizing Networks (SON) Policy Network Resource Model (NRM) Integration Reference Point (IRP): Requirements

32.522: Self-Organizing Networks (SON) Policy Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)

32.523: Self-Organizing Networks (SON) Policy Network Resource Model (NRM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)

32.525: Self-Organizing Networks (SON) Policy Network Resource Model (NRM) Integration Reference Point (IRP): Bulk CM eXtensible Markup Language (XML) file format definition

1 Scope

The present document is part of an Integration Reference Point (IRP) named Self Organizing Networks (SON) Policy Network Resource Model (NRM) IRP, through which an IRPAgent can communicate management information to one or several IRPManagers concerning SON policies. The SON policy NRM IRP comprises a set of specifications defining Requirements, a protocol neutral Information Service and one or more Solution Set(s).

The present document specifies the protocol neutral SON policy NRM IRP: Information Service (IS).

In order to access the information defined by this NRM, an Interface IRP such as the "Basic CM IRP" is needed (3GPP TS 32.602 [11]). However, which Interface IRP is applicable is outside the scope of the present document.

The present document also contains stage 2 descriptions for those functionalities for the Self-Optimization OAM.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[2] 3GPP TS 32.102: "Telecommunication management; Architecture".

[3] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".

[4] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[5] 3GPP TS 32.521: "Telecommunication management; Self-Organizing Networks (SON) Policy Network Resource Model (NRM) Integration Reference Point (IRP): Requirements".

[6] 3GPP TS 36.331: "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[7] 3GPP TS 36.423: "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[8] 3GPP TS 32.425: "Technical Specification Group Services and System Aspects; Telecommunication management; Performance Management (PM); Performance measurements; Evolved Universal Terrestrial Radio Access Network (E-UTRAN)"

[9] 3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)"

[10] 3GPP TS 32.762: "Telecommunication management; Configuration Management (CM); Evolved Universal Terrestrial Radio Access Network (E-UTRAN) network resources Integration Reference Point (IRP): Network Resource Model (NRM)"

[11] 3GPP TS 32.602: "Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP) Information Service (IS)".

[12] 3GPP TS 36.413: "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 32.101 [1], TS 32.102 [2], TS 32.150 [3] and TR 21.905 [4] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TS 32.521 [5], TS 32.101 [1], TS 32.102 [2] and TR 21.905 [4], in that order.

Target: See 3GPP TS 32.521 [5].

Trigger condition: See 3GPP TS 32.521 [5].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [4], TS 32.521 [5] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [4] and TS 32.521 [5].

CAC	CompositeAvailableCapacity
EM	Element Manager
eNodeB	evolved NodeB
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
HO	Handover
HOO	HandOver parameter Optimization
ICIC	Inter Cell Interference Coordination
IOC	Information Object Class
LB	Load Balancing
LBO	Load Balancing Optimization
NM	Network Manager
NRM	Network Resource Model
OAM	Operation Administration Maintenance
SON	Self Organizing Networks
UE	User Equipment

4 SON Policy and Optimization Function Definitions

4.1 Monitoring and Management Operations for Self-Optimization

4.1.1 Monitoring and Management Function

4.1.1.1 Usage of Itf-N

For specifically defined Itf-N NRM Interface see clause 5.

4.2 Load Balancing Optimization Function

4.2.1 Objective and Targets

The objective of LB Optimization is to cope with undesired traffic load distribution and to minimize the number of handovers and redirections needed to achieve the load balancing. One of the following targets or the combination of the following targets shall be used. The specific target value or values shall be configured by operators. Operators should assign priorities for targets being used.

Targets drawn from the following table can be configured for LBO:

Target Name	Definition	Legal Values
RRC connection establishments failure rate related to load	The number of Failed RRC connection establishments related to load/ The total number of Attempted RRC connection establishments	Integer [0..100] in unit percentage
E-RAB setup failure rate related to load	The number of E-RAB setup failure related to load/ The total number of attempted E-RAB setup For E-RAB setup failure related to load, the causes 'Reduce load in serving cell' and 'Radio resources not available' defined in TS 36.413 [12] could be used.	Integer [0..100] in unit percentage
RRC Connection Abnormal Release Rate Related to Load	The number of abnormal RRC connection release related to load/ The total number of RRC connection release	Integer [0..100] in unit percentage
E-RAB Abnormal Release Rate Related to Load	The number of E-RAB abnormal release related to load/ The total number of E-RAB release For E-RAB setup failure related to load, the causes 'Reduce load in serving cell' and 'Radio resources not available' defined in TS 36.413 [12] could be used.	Integer [0..100] in unit percentage
Rate of failures related to handover	(the number of failure events related to handover) / (the total number of handover events)	Integer [0..100] in unit percentage

For the following targets out of the above table, the target values depend on the composite available capacity range in the cell and are defined separately for uplink and downlink. For these tuples can be configured, indicating the capacity ranges together with the target value valid in that range.

RRC connection establishments failure rate related to load,

E-RAB setup failure rate related to load,

RRC Connection Abnormal Release Rate Related to Load,

E-RAB Abnormal Release Rate Related to Load

For the following targets shall be identical with the corresponding targets defined in Handover Optimization.

Rate of failures related to handover

4.2.2 Parameters To Be Optimized

To reach load optimization target, LBO may optimize some mobility settings (HO and/or idle mobility configuration) defined in TS 36.331

4.2.3 Optimization Method

4.2.3.1 Problem Detection

The problem detection is out of scope of this specification.

4.2.3.2 Problem Solution

The problem solution is out of scope of this specification.

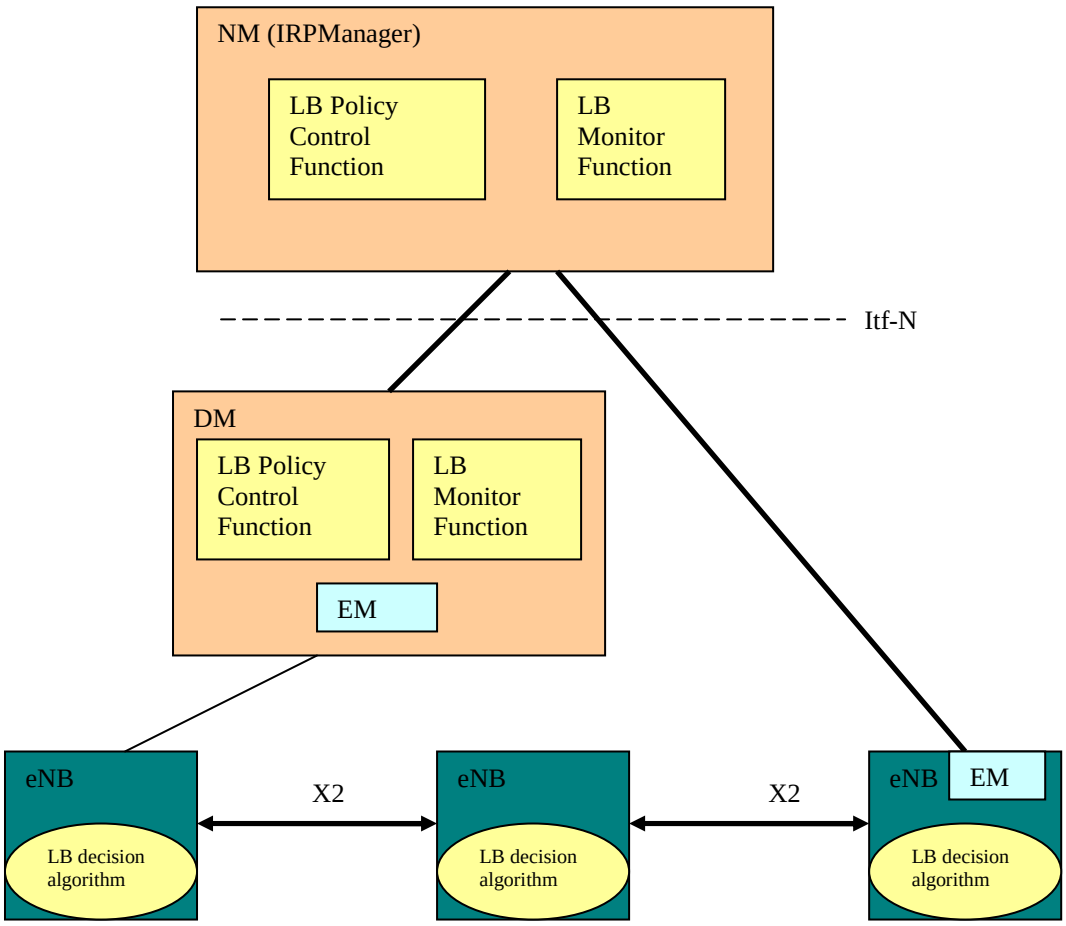
4.2.4 Architecture

4.2.4.1 Definition of Logical Functions

LB Monitor Function: This function is used for monitoring the load balance optimization (e.g. Monitoring related performance counters or alarms).

LB Policy control function: This function is used for configuring the load balance optimization policies.

4.2.4.2 Location of Logical Functions



For Load Balancing, the SON LB decision algorithm is located in eNB. The detailed SON functionalities in eNB are out of scope of this specification.

4.2.5 PM

IRPManager may collect Load balancing related performance measurements. Performance Measurements related with Load balancing are captured in the table below:

Performance measurement name	Description	Related targets
The number of Failed RRC connection establishments related to load	Refer to 3GPP TS 32.425 [8] Failed RRC connection establishments	RRC connection establishments failure rate related to load
The total number of Attempted RRC connection establishments	Refer to 3GPP TS 32.425 [8] Attempted RRC connection establishments	RRC connection establishments failure rate related to load
The number of E-RAB setup failure related to load	Refer to 3GPP TS 32.425 [8] Number of initial SAE Bearers failed to setup	E-RAB setup failure rate related to load
The total number of attempted E-RAB setup	Refer to 3GPP TS 32.425 [8] Number of initial SAE Bearers attempted to setup	E-RAB setup failure rate related to load
The number of abnormal RRC connection release related to load	Number of UE CONTEXT Release Request initiated by eNodeB	RRC Connection Abnormal Release Rate Related to Load
The total number of RRC connection release	Number of Successful UE Context Release	RRC Connection Abnormal Release Rate Related to Load
The number of E-RAB abnormal release related to load	Refer to 3GPP TS 32.425 [8] Number of SAE Bearers requested to release initiated by eNodeB per cause	E-RAB Abnormal Release Rate Related to Load
The total number of E-RAB release	Refer to 3GPP TS 32.425 [8] Number of SAE Bearers successfully released	E-RAB Abnormal Release Rate Related to Load
the number of failure events related to handover	Refer to 4.3.5	Rate of failures related to handover
the total number of handover events	Refer to 4.3.5	Rate of failures related to handover

NOTE: The monitoring of performance measurements will make use of existing PM IRP.

4.3 Handover (HO) Parameter Optimization Function

4.3.1 Objective and Targets

For intra-LTE, one of the following targets or the combination of the following targets shall be used. The specific target value shall be configured by operators. Operators should assign priorities for targets being used. The first priority target will be tried to achieve by SON entity firstly. The lower priority targets will be tried to achieve based on precondition that the higher priority targets have already been achieved.

Target Name	Definition	Legal Values
Rate of failures related to handover	(the number of failure events related to handover) / (the total number of handover events)	Integer [0..100] in unit percentage

The objective of minimizing the number of unnecessary handovers shall always be pursued in case the other target/s configured by the operator is/are achieved. This objective may not need configuration of a target value.

4.3.2 Parameters To Be Optimized

The tables below summarise the handover parameters in TS 36.331 [6].

Table 4.3.2-1. Handover parameters that may be optimized for intra-frequency and inter-frequency handovers

Event	Summary	Tunable parameters
A3	Neighbour becomes offset better than serving	Ofn, Ofs, Ocn, Ocs, Hys, Off, timeToTrigger
A4	Neighbour becomes better than threshold	Ofn, Ocn, Hys, Thresh, Off, timeToTrigger
A5	Serving becomes worse than threshold1 and neighbour becomes better than threshold2	Ofn, Ocn, Hys, Thresh1, Thresh2, Off, timeToTrigger

Table 4.3.2-2. Handover parameters that may be optimised for inter RAT handover

Event	Summary	Tunable parameters
B1	Inter RAT Neighbour becomes better than threshold	Ofn, Hys, Thresh, timeToTrigger
B2	Serving becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2	Ofn, Hys, Thresh1, Thresh2, timeToTrigger

4.3.3 Optimization Method

4.3.3.1 Problem Detection

HO Parameter Optimization Function shall focus on detecting the problem scenarios described in 32.521 [5]; namely: too early handovers, too late handovers and inefficient use of NW resources due to HOs. For more information about these scenarios see 32.521 [5] section 6.1.3.

The following inputs may be used for the identification of the problem scenarios:

- Event capture and analysis
- UE measurements
- Performance measurements

In event capture and analysis, the eNodeB exploits event information associated with a UE context, such as evidence of previous handovers (UE History, see 36.423 [7]) and HO failure details (such as in which cell the handover failed and where the UE re-established the connection).

UE measurements are sent within UE measurement reports and they may indicate whether HOs are too early or too late.

HO-related performance measurements (PMs) collected at the source and / or target eNB can be useful in detecting HO-related issues on the cell level. Since the impact of incorrect HO parameter setting will also be on the cell-level, PMs can provide useful information that can be used to detect and resolve HO-related issues due to incorrect parameter settings.

4.3.3.2 Problem Solution

HO Parameter Optimization Function will aim at optimizing the HO parameters listed in Section 4.3.2 in such way to mitigate the problem scenarios discussed in Section 4.3.3.1. The optimization algorithms will not be specified. The exact set of HO parameters that may be adjusted by the algorithms is dictated by the choice of triggered HO measurements made by the RRM entity in an eNodeB.

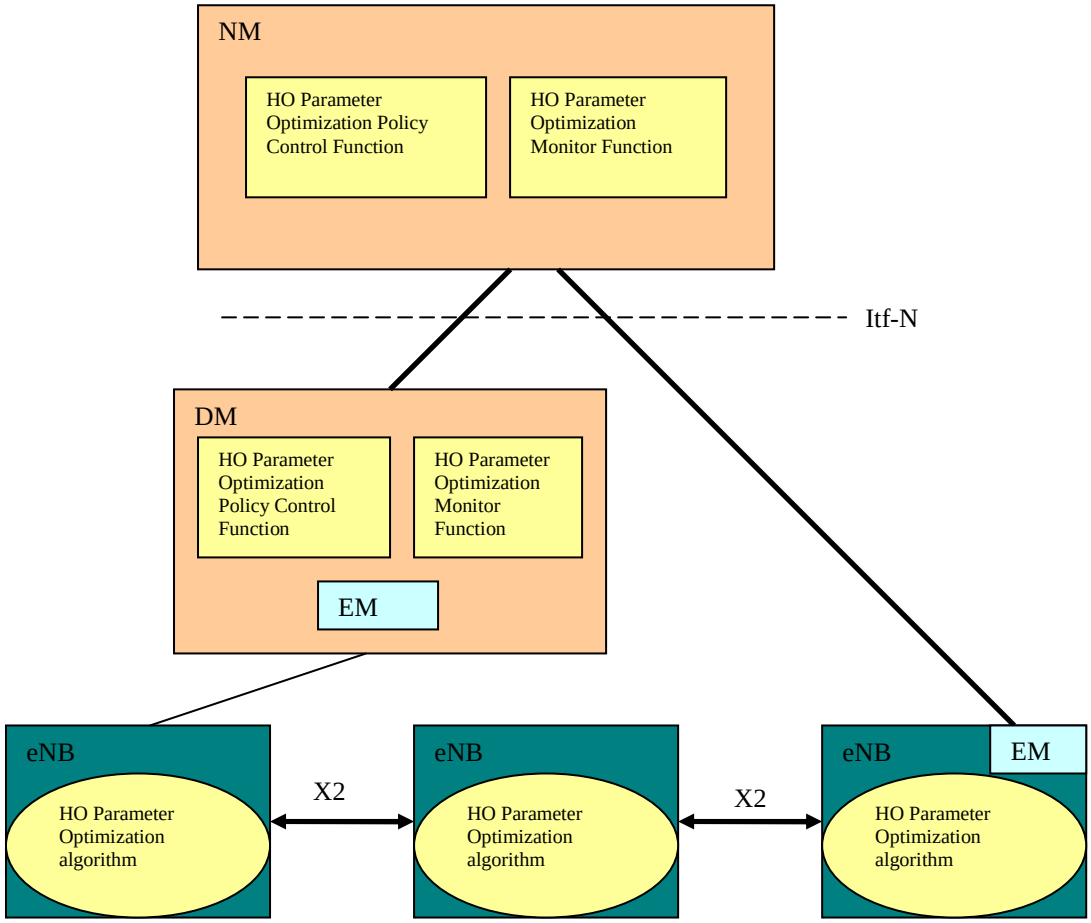
4.3.4 Architecture

4.3.4.1 Definition of Logical Functions

HO Parameter Optimization Monitor Function: This function is used for monitoring the handover parameter optimization (e.g. monitoring related performance counters or alarms).

HO Parameter Optimization Policy Control Function: This function is used for configuring the handover parameter optimization policies.

4.3.4.2 Location of Logical Functions



For handover parameter optimization, the SON algorithm is located in eNB. The detailed SON functionalities in eNB are out of scope of this specification.

4.3.5 PM

IRPManager shall collect HO-related performance measurements from the source and / or target eNB which can be useful in detecting HO-related issues on the cell level. The following input can be used for the identification of the problem scenarios specified:

The number of RLF event happened within a interval after handover success

Performance Measurements related to handover failure are captured in the table below.

The Performance Measurements are for outgoing handovers. Further, they should be available on a cell relation basis.

Performance measurement name	Description	Related targets
Number of handover events	Includes successful handovers plus all identified failures	Rate of failures related to handover
Number of HO failures	All failure cases	Rate of failures related to handover
Number of too early HO failures	Too early HO failure cases	Rate of failures related to handover
Number of too late HO failures	Too late HO failure cases	Rate of failures related to handover
Number of HO failures to wrong cell	HO failures to wrong cell	Rate of failures related to handover

NOTE: The monitoring of performance measurements will make use of existing PM IRP.

4.4 Interference Control Function

4.5 Capacity and Coverage Optimization Function

4.6 RACH Optimization Function

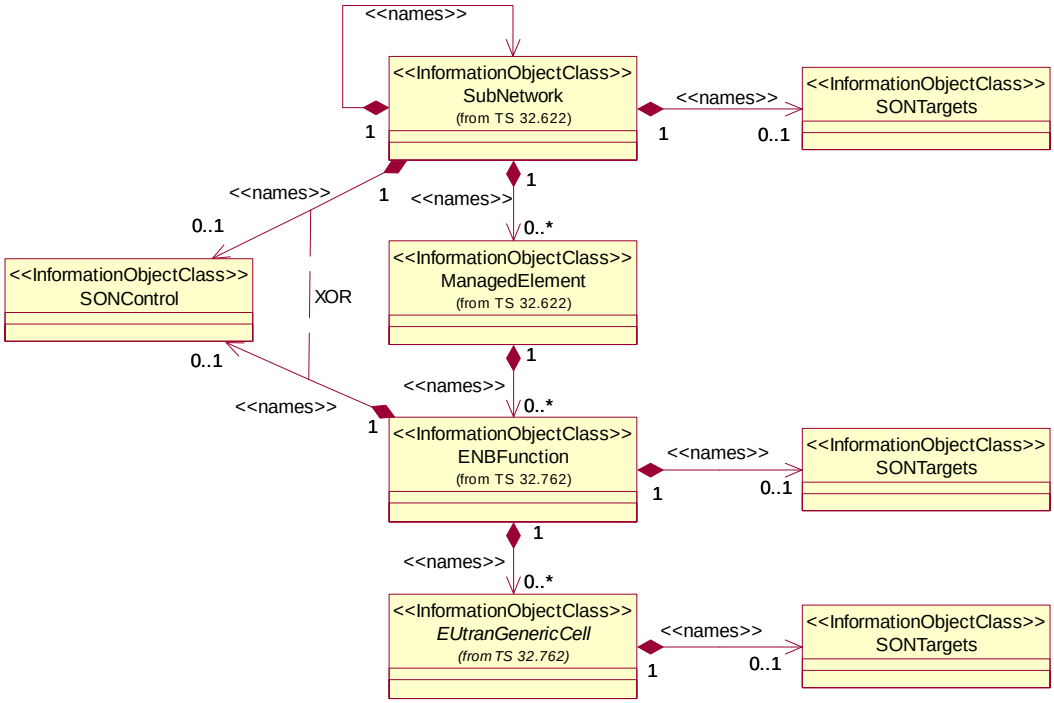
5 Information Object Classes (IOCs)

5.1 Information entities imported and local labels

Label reference	Local label
3GPP TS 32.622 [9], IOC, `Top`	`Top`
3GPP TS 32.622 [9], IOC, `SubNetwork`	`SubNetwork`
3GPP TS 32.762 [10], IOC, `ENBFunction`	`ENBFunction`
3GPP TS 32.762 [10], IOC, `EUtranRelation`	`EUtranRelation`
3GPP TS 32.762 [10], IOC, `EUtranGenericCell`	`EUtranGenericCell`

5.2 Class diagram

5.2.1 Attributes and relationships



NOTE: IOC `SONControl` shall be instantiated whenever one or more IOC `SONTargets` are instantiated.

Figure 5.2.1.1: Cell view of SON Policy NRM

5.2.2 Inheritance

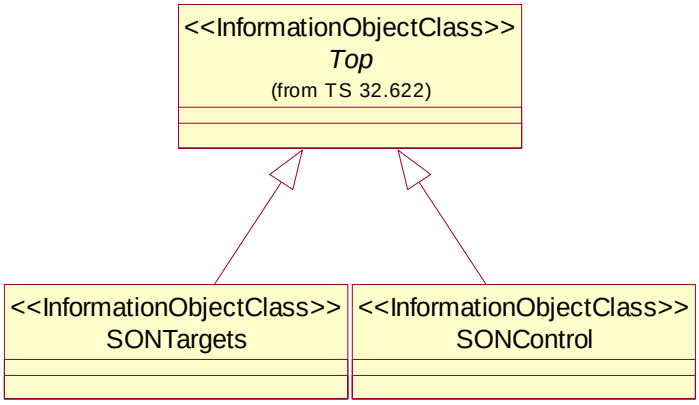


Figure 5.2.2.1: SON Policy NRM Inheritance Hierarchy

5.3 Information Object Class (IOC) definitions

5.3.1 SONTargets

5.3.1.1 Definition

This IOC represents targets for SON functions and their relative priorities. Currently targets for Handover parameter optimization and Load Balancing optimization are defined. Targets for other SON functions like Energy Saving, Coverage and Capacity optimization, RACH optimization etc. are FFS.

Target hierarchy:

If an NRM IOC instance I^{high} contains an IOC SONTargets instance T^{high} and other NRM IOC instances I_{low} , then the targets in T^{high} are valid for I^{high} and I_{low}, with the following exception:

If an NRM IOC instance I_{low} contains an IOC SONTargets instance T_{low} and possibly other NRM IOC instances I_{lowlow} h, then the targets in T_{low} are valid for I_{low} (and not those of T^{high}) and I_{lowlow}.

5.3.1.2 Attributes

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
hoFailureRate	O *)	M	M
rrcConnectionEstablishmentFailureRateCharacteristic	O *)	M	M
rrcConnectionAbnormalReleaseRateCharacteristic	O *)	M	M
eRabSetupFailureRateCharacteristic	O *)	M	M
eRabAbnormalReleaseRateCharacteristic	O *)	M	M

*1) Note: At least one of the attributes shall be supported.

5.3.1.3 Attribute constraints

None

5.3.1.4 Notifications

The common notifications defined in subclause 6.6.1 are valid for this IOC, without exceptions or additions.

5.3.2 SONControl

5.3.2.1 Definition

This IOC represents the possibility to switch on or off SON functions. This is provided for Handover optimization and Load Balancing optimization. For other SON functions like Energy Saving, Coverage and Capacity optimization, RACH optimization etc. this is FFS.

5.3.2.2 Attributes

Attribute name	Support Qualifier	Read Qualifier	Write Qualifier
hooSwitch	O *)	M	M
lboSwitch	O *)	M	M

*) NOTE: At least one of the attributes shall be supported.

5.3.2.3 Attribute constraints

None.

5.3.2.4 Notifications

The common notifications defined in subclause 6.6.2 are valid for this IOC, without exceptions or additions.

5.4 Information relationship definitions

None.

5.5 Information attribute definitions

5.5.1 Definition and legal values

Table 5.5.1.1 defines the attributes that are present in the Information Object Classes (IOCs) of the present document.

Table 5.5.1.1: Attributes definitions and legal values

Attribute Name	Definition	Legal Values
eRabAbnormalReleaseRateCharacteristic	The target is on the number of E-RAB abnormal release related to load divided by the total number of attempted E-RAB setups. This attribute allows to define for a value the composite available capacity (CAC) range in which the target is valid. For this, it contains one characteristic dependent on Uplink CAC, one for Downlink CAC: eRabAbnormalReleaseRateCharacteristicDownlink and eRabAbnormalReleaseRateCharacteristicUplink. At least one of these charateristics must be present. Together with the characteristic its targetPriority as a SON target is defined as part of this attribute. The characteristics have the following structure: eRabAbnormalReleaseRateCharacteristicDownlink: List of one or more entries, each consisting of: lowerEndOfCacRange, upperEndOfCacRange, eRabAbnormalReleaseRateTarget eRabAbnormalReleaseRateCharacteristicUplink: List of one or more entries, each consisting of: lowerEndOfCacRange, upperEndOfCacRange, eRabAbnormalReleaseRateTarget Remark: Formula for composite available capacity: Available Capacity = Cell Capacity Class Value * Capacity Value For definition of Cell Capacity Class Value and Capacity Value see TS 36.331 [6]. These definitions lead to a value range of a composite available capacity from 0..10000. 36.423 [7] has cell capacity class value as optional parameter in case of intra-LTE load balancing. If cell capacity class value is not present, than 36.423 assumes that bandwidth should be used instead to assess the capacity. This target is suitable for LBO.	lowerEndOfCacRange and upperEndOfCacRange: Integer 0..10000 eRabAbnormalReleaseRateTarget: Integer 0..100 (representing a percentage) targetPriority: Integer 0..N. The lower the number the higher the priority.

eRabSetupFailureRateCharacteristic	The target is on the number of E-RAB setup failures related to load divided by the total number of attempted E-RAB setups. For E-RAB setup failure related to load the causes 'Reduce load in serving cell' and 'Radio resources not available' defined in TS 36.413 are used. This attribute allows to define for a value the composite available capacity (CAC) range in which the target is valid. For this, it contains one characteristic dependent on Uplink CAC, one for Downlink CAC: eRabSetupFailureRateCharacteristicDownlink and eRabSetupFailureRateCharacteristicUplink. At least one of these charateristics must be present. Together with the characteristic its targetPriority as a SON target is defined as part of this attribute. The characteristics have the following structure: eRabSetupFailureRateCharacteristicDownlink: List of one or more entries, each consisting of: LowerEndOfCacRange, UpperEndOfCacRange, eRabSetUpFailureRateTarget eRabSetupFailureRateCharacteristicUplink: List of one or more entries, each consisting of: LowerEndOfCacRange, UpperEndOfCacRange, eRabSetUpFailureRateTarget For CAC see eRabAbnormalReleaseRateCharacteristic This target is suitable for LBO.	lowerEndOfCacRange and upperEndOfCacRange and targetPriority: See eRabAbnormalReleaseRateCharacteristic eRabSetUpFailureRateTarget: Integer 0..100 (representing a percentage)
hoFailureRate	This indicates the assigned HOO target of the number of failure events related to handover divided by the total number of handover events, together with its targetPrioritiy. This target is suitable for HOO or LBO.	A set of two numbers: the first indicates a percentage, the second a targetPriority (see eRabAbnormalReleaseRateCharacteristic).
hooSwitch	This attribute determines whether the Handover parameter Optimization Function is activated or deactivated.	On, off
lboSwitch	This attribute determines whether the Load Balancing Optimization Function is activated or deactivated.	On, off

rrcConnectionAbnormalReleaseRateCharacteristic	The target is on the number of abnormal RRC connection releases related to load divided by the total number of RRC connection releases. This attribute allows to define for a value the composite available capacity (CAC) range in which the target is valid. For this, it contains one characteristic dependent on Uplink CAC, one for Downlink CAC: rrcConnectionAbnormalReleaseRateCharacteristicDownlink and rrcConnectionAbnormalReleaseRateCharacteristicUplink. At least one of these charateristics must be present. Together with the characteristic its targetPriority as a SON target is defined as part of this attribute. The characteristics have the following structure: rrcConnectionAbnormalReleaseRateCharacteristicDownlink: List of one or more entries, each consisting of: lowerEndOfCacRange, upperEndOfCacRange, rrcConnectionAbnormalReleaseRateTarget rrcConnectionAbnormalReleaseCharacteristicUplink: List of one or more entries, each consisting of: lowerEndOfCacRange, upperEndOfCacRange, rrcConnectionAbnormalReleaseRateTarget For CAC see eRabAbnormalReleaseRateCharacteristic This target is suitable for LBO.	lowerEndOfCacRange and upperEndOfCacRange and targetPriority: See eRabAbnormalReleaseRateCharacteristic rrcConnectionAbnormalReleaseRateTarget: Integer 0..100 (representing a percentage)

rrcConnectionEstablishmentFailureRateCharacteristic	The target is on the number of RRC connection establishment failures related to load divided by the total number of attempted RRC connection establishments. This attribute allows to define for a value the composite available capacity (CAC) range in which the target is valid. For this, it contains one characteristic dependent on Uplink CAC, one for Downlink CAC: rrcConnectionEstablishmentFailureRateCharacteristicDownlink and rrcConnectionEstablishmentFailureRateCharacteristicUplink. At least one of these charateristics must be present. Together with the characteristic its targetPriority as a SON target is defined as part of this attribute. The characteristics have the following structure: rrcConnectionEstablishmentFailureRateCharacteristicDownlink: List of one or more entries, each consisting of: lowerEndOfCacRange, upperEndOfCacRange, rrcConnectionEstablishmentFailureRateTarget rrcConnectionEstablishmentFailureRateCharacteristicUplink: List of one or more entries, each consisting of: lowerEndOfCacRange, upperEndOfCacRange, rrcConnectionEstablishmentFailureRateTarget For CAC see eRabAbnormalReleaseRateCharacteristic This target is suitable for LBO.	lowerEndOfCacRange and upperEndOfCacRange and targetPriority: See eRabAbnormalReleaseRateCharacteristic rrcConnectionEstablishmentFailureRateTarget: Integer 0..100 (representing a percentage)

5.5.2 Constraints

None.

5.6 Common Notifications

5.6.1 Configuration notifications

Name	Qualifier	Notes
notifyAttributeValueChange	O	
notifyObjectCreation	O	
notifyObjectDeletion	O	

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-03	SA#47	SP-100053	--	--	Presentation to SA for Information and Approval	--	1.0.0
2010-03	--	--	--	--	Publication of SA approved version	1.0.0	9.0.0
2010-09	SA|#49	SP-100491	001	--	Remove targets based on not supported by measurements	9.0.0	9.1.0

History

Document history		
V9.0.0	April 2010	Publication
V9.1.0	October 2010	Publication